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Again, there was no doubt in regard to the fact that the ciliated line or slit extending from the disk down the body of the animalcule became apparent only after it had been some time under observation, and that the length and activity of the cilia along it increased rapidly within a very few minutes, so as to become a striking and marked feature of its appearance. This raises the question whether the fringe of cilia down the body, as described, is a specific characteristic of the *Stentor Mülleri*, or is not rather a mark of the beginning of fission in all Stentors, — a question which an amateur naturalist may state, but will not presume to express an opinion upon.

In the instance above reported it is noteworthy that, except in the first appearance of the ciliated line down the body, there was nothing resembling a division by cutting or splitting. The body was of larger diameter than before, both above and below the new disk, when it first assumed the form of a protuberance with a ciliated circle on its anterior side; and the subsequent diminution of the diameter of the body and tail of the upper individual was gradual throughout its length, through the stages shown by the drawings.

The observations were made with a quarter-inch objective of low angle, but excellent definition and penetration, with the B eyepiece, and the situation of the Stentor in the compressor was very favorable for an unobstructed view of the phenomena at all stages.

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PRIMITIVE MAN.[1]

THE steady progress of discovery justifies the inference that man, in the earliest periods of his existence of which we have any knowledge, was at the best a savage, enjoying the advantage of a few rude inventions. According to the theory of evolution, which has the merit of being based on and not being inconsistent with observed analogies and processes of nature, he must have gone through a period when he was passing out of the animal into the human state, when he was not yet provided with tools of any sort, and when he lived simply the life of a brute.

No proofs, however, of man in this earliest stage have as yet been found, and the term "primitive man," if intended to be strictly applied, is at present a misnomer. The earliest traces thus far discovered do not reveal to us his beginning. This is still hidden in that mysterious past out of which he has emerged and into which neither science nor exploration has as yet penetrated. The ancient remains found in California, brought to the notice of the scientific world by Professor J. D. Whitney, and referred by him to the tertiary period, exhibit man as a maker of instruments for grinding grain, and other implements of stone, and, as far as an imperfect skull goes, essentially the same in his anatomical features as now. Or should those instances be set aside, as some geologists, waiting for further discoveries, are inclined to do, we still have remains from the gravels of the Somme in France, as well as the Ouse and other localities in England. Some of these last, Mr. Evans believes, date back to the time when the Needles of the Isle of Wight were connected with the mainland, the sea of Solent was the mouth of a river, and Britain was probably still a peninsula. The time since these conditions existed may not, he says, be estimated by years, but unquestionably extends back an immense period beyond that covered by history. The abundance of flint implements belonging to the gravels above referred to shows that man was then and there far from being primitive.

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[1] From the late Professor Wyman's Shell-Mounds of Florida.

If the theory of evolution be true, and man was ever in a transitional or strictly primitive state, without tools or implements, it will be obvious that all the knowledge we can expect ever to have of him in this condition must come through the remains of his own body, older than his inventions, which will carry us back still further towards, if not to, his starting-point, as the geologist is carried back in time to the early period of the existence of animals. Even with regard to these, geology fails to reveal to us their actual beginning. Possibly the early remains of man may never be known, for during the revolutions which have taken place on the surface of the earth and the inroads which the sea has made upon the land, if a suggestion of Cuvier may be accepted, "the places where he [man] dwelt may have been utterly destroyed and his bones buried at the bottom of the existing seas."

It is almost certain that his bones, if simply left on the surface, would, like those of land animals generally, be soon entirely destroyed, either by the effects of the weather or by their consumption for food by wild animals. Nothing can be more striking than the complete destruction of the bones of the birds and reptiles, some of gigantic size, which once thronged the shores in the valley of the Connecticut River. Were it not for the preservation of their seemingly more perishable footprints, the mere knowledge that they once lived would not now exist. The same is doubtless true of other kinds whose habitat was inland, and whole races of mammals and birds may have once existed of which no traces whatever remain, and this too within comparatively recent times. Keeping these considerations in view, it seems not at all improbable that the same fate may have befallen the remains of the earliest man.

As the ease with which food can be procured determines the habitat of animals, so also it determines that of man, and this naturally brings him to the shores of seas, lakes, and rivers, where it can be had with the greatest ease. It is hardly conceivable that he could, under any circumstances, at once have entered upon an agricultural or hunter life, since these both require expedients and inventions which long experience and education alone can give. Without tools or inventions of any sort, life in the forest, it would seem, would be for him almost impossible. Be this as it may, the wide geographical distribution of shell-heaps shows how generally man has been attracted by the kinds of food the shores yield, including not only shell-fish but fish and game, and the extent to which they have supplied his wants in his early periods. They are found at intervals along the whole Atlantic coast of the United States from the Bay of Fundy to the Gulf of Mexico, on the shores of California and northward to Behring's Sea, in Central America, the Gulf of Guayaquil, on the coast of Brazil, Patagonia, and Terra del Fuego, on the shores of England, Scotland, Ireland, France, and Denmark, in the Malay Peninsula, in Australia and Tasmania, and will doubtless be discovered in still other parts of the world.

Besides those just mentioned, other shell-heaps have been found on the interior rivers of the continent, especially the Mississippi and its tributaries. Atwater, who was the pioneer in inquiries relating to them, described the mounds of mussel shells on the banks of the Muskingum, containing various articles of human make, and LeSueur and Say explored a mound at New Harmony, Indiana, as early as 1826. Since then Dr. D. G. Brinton, Dr. Cox, Generals Humphreys and Abbott, and Professor C. A. White have described many other localities in the great Mississippi Valley where they exist in large numbers, and show how generally the habit of eating shell-fish prevailed in that region. In addition to the fresh-water shell-heaps of the St. John's, Florida, we have examined a well-defined shell-heap on the shores of the Concord, in Massachusetts, consisting of *Unio complanatus*, living specimens of which can be had from the river near by. This shell-heap contains charcoal and pieces of worked bone and stone. It had been previously visited by the late H. D. Thoreau, who regarded it as an ancient Indian dwelling-place, though he published no account of it. Quite recently Professor Hartt, of Cornell University, has explored some of the interior fresh-water shell-mounds of Brazil, which are very extensive, selections from which are preserved in the Peabody Museum at Cambridge.

The study of the works of man from the oldest shell-heaps, the only records left of the progress their builders had made, tends to show that he was as far advanced at least as are the miserable creatures the traveler meets with now in the Straits of Magellan, or as are the Dyacks of Borneo, the Australians, or the Andaman Islanders. In other words, we have the life of man manifested now in a condition as primitive and no more advanced towards civilization than in the earliest prehistoric periods which have thus far been studied.

The only records we have of the earliest inhabitants of the St. John's River are the shell-mounds and the comparatively few implements they contain. Judging from these of the progress the natives had made, it is clear that they too had passed out of the primitive stage, had become hunters, had made some progress in the useful arts ; and, however rude their implements, they were such as could only have been the result of long-continued efforts. They have left no signs of having learned the art of agriculture, but their tools, if they had any, may have been of a perishable nature. In the oldest mounds no pottery has been discovered, the builders of them no doubt having been ignorant of it. Though implements of wrought shell, bone, and stone are met with, they are not numerous, and those of stone from the interior of the mounds are quite rare.

The bones of animals obtained by hunting on land are in comparatively small numbers, so that, far as indications go, the older natives subsisted chiefly on fish and shell-fish. This is strikingly the case at the mound on Huntoon Creek, Osceola Mound, the mound next above Blue Spring, and at Horse Landing. Whether the inhabitants who built and dwelt upon the older shell-heaps, or even upon the later ones, were the same people the first explorers found occupying the shores of the St. John's is uncertain. The Indians who lived in Florida later had no traditions with regard to those who preceded them in remote times, nor is it to be expected that they should have, for they were not the descendants of the original inhabitants, but were comparatively recent immigrants themselves. The early explorers make no reference whatsoever to the shell-mounds on the river, though they could hardly have failed to do so if these had continued to be occupied as dwelling-places, and the fresh-water shells were still to be used to any considerable extent as articles of food. They distinctly state that the natives lived by hunting and agriculture, describe the details of carrying on these operations, the preparation of dried meat, and mention the different articles, animal and vegetable, used, their mode of collecting food in granaries, and of preparing them ; but nothing is said of the shell-fish. The inference is that the shell-mounds had already ceased to be occupied as dwelling-places, and that the natives had outlived the mode of life which gave rise to them, or had been replaced by others of different habits.

This conclusion is consistent with the fact that trees are now growing on some of the mounds, which are older than the discovery of America.

Unfortunately, we have no satisfactory means of making a comparison between the older and the later inhabitants, derived from parts of the human skeleton. There is an abundance of crania and bones taken from the burial-mounds, but it is hardly safe to assume that these represent the earliest dwellers on the St. John's. The bones from Osceola Mound and those from Rock Island, in Lake Munroe, are the only ones we have met with which can be claimed to be unequivocally contemporaneous with the earliest shell-heaps. The skull from the first of these places has anatomical peculiarities which differ from those of the skulls of the burial-mounds, but as there is but one, it may be exceptional.

The relation of the older to the later inhabitants, that is, of those dwelling on the St. John's centuries before and at the time of the first explorations, must remain for the present a matter of doubt. We need more complete explorations of the burial mounds than have as yet been made, and more complete anatomical comparisons of the crania and bones.

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THE CAVE BEETLES OF KENTUCKY.

BY A. S. PACKARD, JR.

THOSE who have gone the rounds of Mammoth Cave, crossed the river Styx, with its muddy banks, passed through Fat Man's Misery, through the damp passages of the Labyrinth,